PERFORMANCE AND ECONOMY OF PRODUCTION OF GROWING RABBITS FED DIETARY REPLACEMENT OF YELLOW MAIZE WITH GRADED LEVELS OF RED SORGHUM WITH OR WITHOUT ENZYME (*ENZYBLEND®*)

Tarhemba, F., Torhemen, M., Mashi A.M., Wayo S.N and Sarwuan G.D.
Department of Animal Health and Production Technology, Akperan Orshi Polytechnic, Yandev Gboko.
Corresponding author: tarhembafrancis@mail.com

ABSTRACT
Maize is one of the major sources of energy in rabbits feed. The use of sorghum is to reduce prices in feeds and effect of replacing maize as energy source for rabbit demands research. A study lasting 84 days was conducted at the Teaching and Research Farm of the Department of Animal Health and Production Technology, Akperan Orshi Polytechnic Yandev, Gboko to evaluate the performance and cost effectiveness of replacing yellow maize with red sorghum in rabbit diets with or without enzyme. A total of 54 weaner rabbits of mixed breed and sexes with initial body weight of 690.84-794.83g were assigned to nine dietary treatments containing six rabbits per treatment with one rabbit per replicate in a completely randomized design of 4×2+1 factorial arrangement having two levels of enzyblend supplementation (with & without). Dietary treatments included: D1: 0 %, D2 :25 %, D3: 50 %, D4 :75 % D5: 100 % red sorghum replacement. The results showed that, increase in the replacement level of sorghum had significant ($p<0.05$) effects on intake, final weight and average daily weight gain except feed conversion ratio which did not significantly ($p>0.05$) differed. The results of economic of production showed that the cost per kg diet decreased progressively from 0 (control) to 100 % (₦222.42-₦200.81/kg and ₦222.42-₦199.92/kg) sorghum inclusion levels with and without enzyme supplementation respectively. The feed cost/gain also followed the same trend from control to 100 % (₦1512.46 - ₦1217.51 and ₦1512.46-₦1164.70) with or without enzymes supplementation. A marginal profit was also better for rabbits fed diets with 100 % sorghum replacement level with or without (₦695.62 and ₦592.58) enzyme supplementation which represents a favourable economic implication. The study therefore recommends 100 % sorghum inclusion level to farmers for improved growth and profitability in rabbit production

Key-words: Performance, Economy of production, maize, sorghum, enzyblend, rabbits

INTRODUCTION

Rabbit meat production has increased considerably in order to meet the increasing demand for animal protein, and to seek alternative to poultry meat, which has declined since the advent of avian influenza (Owen *etal*. 2008). Rabbit meat is also increasingly becoming popular because it is nutritious, low in fat and cholesterol, compared beef, chicken, mutton or pork. The meat is white fine grained, delicately flavoured, nutritious and appetizing (Cheeke, 1994). Sorghum (*Sorghum bicolor*) is the variety of grasses within the genus Sorghum. These plants are used for grain, fibre and fodder. The plants are cultivated in warmer climates worldwide.

AOAC (2005) reported the following values for proximate value of 90.10 and 87.34 % dry matter, 90.53 and 93.76 organic matter, 9.65 and 11.62 % crude protein, 3.98 and 2.92 % ether extract, 1. 99 and 4.83 % crude fibre, 9.47 and 6.24 % ash, 73.46 and 67.97 % nitrogen-free extract and 3271 and 3087 ME, kcal/kg for maize and sorghum respectively. This research was conducted to evaluate the performance and cost effectiveness of replacing maize with sorghum graded level with or without enzymes in rabbit diets.

MATERIALS AND METHODS

The study was conducted in the Teaching and Research Farm of the Department of Animal Health and Production Technology, Akperan Orshi Polytechnic Yandev, Gboko. Fifty-four (54) weaner rabbits of mixed strains and sexes were used for the study. The rabbits were randomly assigned to nine (9) dietary treatments with six (6) replicates each in a Completely Randomized Design (CRD) with one animal per replicate. Each experimental animal served as a replicate using a factorial arrangement. The rabbits were initially fed on respective experimental diets and water *ad libitum* during acclimatization period of seven (7) days while data collection commenced at the end of adjustment period. All health and management practices were strictly adhered to. Data collected were subjected to Analysis of Variance (ANOVA) (Steel and Torrie, 1980), and Duncan multiple Range Test was used to separate the means (Duncan, 1995).

Experimental Diets: Nine dietary treatments were formulated with diet 1 (control diet) containing 100% maize. In the other remaining diets maize was replaced 25, 50, 75 and 100% sorghum inclusion level with or without enzymes. Each of the diets (2, 3, 4 and 5) was formulated twice with T_2, T_4, T_6 and T_8 containing no enzyme while T_3, T_5, T_7 and T_9 were contained enzyme (*Enzyblend*®). The diets were formulated to meet the nutritional requirements of the rabbits as presented in Table 1

Performance Data: Feed consumption for each treatment was computed daily by subtracting leftover from feed served. Adequate measures were taken to safeguard against spoilage and related wastage.

The average daily weight gain (AWG) for each rabbit was obtained as the difference between the initial and the final weights of each rabbit by dividing by eighty-four (84).

Feed conversion ratio (FCR) was determined by calculation as feed intake during the experiment divided by body weight gain.

Economics of Production: - The cost of gain of the experimental rabbits on each diet were determined at the end of study. The economic analysis was based on the prices of the feed ingredients used during the study period. The cost per kg of each diet, total feed intake per rabbit and the cost per kilogram of weight gain by each rabbit were assessed. The control was compared with other diets to ascertain the cost saved or otherwise.

RESULTS AND DISCUSSION: -

The results of the main and interactive effects of feeding sorghum as a replacement for maize with or without enzyme supplementation on growth performance of rabbits is presented in Table 2. There were significant ($p<0.05$) differences in the final weight, average daily weight gain and average daily feed intake in rabbits on different levels of sorghum in the diet. Final body weight was highest ($p<0.05$) in rabbits on diet with 100 % sorghum compared to those on control diet, 50 and 75 % sorghum inclusion. Final body weight in 100 % sorghum inclusion was however comparable in rabbits on diet containing 25 % sorghum. Average daily body weight had comparable values with rabbits on diets containing 0, 25 and 50 % sorghum, but decreased ($p<0.05$) in rabbit on diet containing 75 % sorghum. Average daily feed intake was higher ($p<0.05$) in rabbit on diets containing sorghum at 100 %. This was however, comparable to rabbits on all sorghum based diets, but reduced ($p<0.05$) in the control diet. Feed conversion ration remained unchanged ($p>0.05$) with inclusion of different levels of sorghum in the diets, however it was better ($p<0.05$) in rabbits on 100 % sorghum inclusion with enzyme supplementation. All growth parameters measured were not affected by enzyme supplementation. A significantly higher growth rate observed at 100 % sorghum replacement is indication that sorghum can effectively replace maize in rabbit diets at 100 %. Such improvement in growth rate may be attributed to the higher crude protein levels in sorghum compared to maize as crude protein of sorghum measured in this study was superior to maize. Okeke *et al.* (2019) reported that, the improvement in the average daily weight gain of rabbits could be as a result of the higher crude protein content of the test

ingredients as contained in the diets. This is more so that other researches to replace maize with other feed ingredients beyond 50 % showed a reduced growth rate (Pasquali *et al.* 2016; Shaahu *et al.* 2020). The significant differences observed in growth indices in this present study is at variance with report of Ogunsipe and Agbede (2012) who recorded no significant ($p>0.05$) difference in growth performance of rabbits on millet offal based diets.

Table 2: Main Effect of Feeding Sorghum and Sorghum with Enzyme on Growth Performance Rabbits

Parameter		Levels of Sorghum					Levels of Enzyme		
	Control 0	25	50	75	100	SEM	0	+	SEM
Initial wt.	690.84	740.58	698.33	697.92	690.50	7.49	692.80	691.60	7.49
Final wt.	1802.17^{b}	1865.25^{ab}	1801.00^{b}	1779.50^{b}	2053.67^{a}	32.02	1930.57	1790.07	32.02
ADWG	13.23^{ab}	13.89^{ab}	13.13^{ab}	12.88^{b}	16.23^{a}	0.40	14.70	13.04	0.40
ADFI	90.02^{c}	93.63^{abc}	94.66^{ab}	90.87^{bc}	96.42^{a}	0.58	94.09	92.15	0.58
FCR	6.80	6.74	7.21	7.06	5.94	0.19	6.40	7.07	0.19

0=No enzyme mean value += Enzyme supplementation mean value. SEM= Standard error of mean, Enzyme= Enzyblend ® 0.05 g, ADWG= average daily weight gain, ADFI= average daily feed intake, FCR= feed conversion ratio

Table 3 represent the economics of production of rabbits fed diets containing graded levels of sorghum meal. Cost per kg diet ranged between 199.92 naira in 100 % sorghum diet without enzyme supplementation to 222.42 naira in control diet sorghum groups. As the amount of sorghum in the diet increased, there was a reduction ($P<0.05$) in the cost of diet/kg. Similar trend was also observed in the sorghum groups with enzyme supplementation. Cost of feed/kg diet was 217.68, 212.06, 206.44 and 200.81 naira for enzyme supplementation groups with sorghum at 25, 50, 75 and 100 %, respectively. Cost/gain was higher ($p<0.05$) 50 % sorghum with enzyme supplementation group (1766.46), and least ($p<0.05$) in 100 % sorghum level with enzyme group (1164.70). The cost per weight gain was 1512.46, 1402.44, 1343.04, 1518.94 and 1217.51 naira in control, 25, 50 and 75 and 100 % sorghum groups without enzyme supplementation, respectively. For groups with enzyme supplementation, cost of feeding/kg weight gain was 1660.90 and 1519.40 naira in 25 and 75 % sorghum levels, respectively. Profit margin was highest ($p<0.05$) in 100 % sorghum group without enzyme (₦695.62), this was followed by 100 % sorghum levels with enzyme (₦592.58). Fewer profit margins were observed in other sorghum groups (25, 50 and 75 %) with enzyme, compared to control and other sorghum levels group without enzyme.

Table 3: Economic Production of Growing Rabbits Fed Experimental Diet

Parameters	No Enzyme					Enzyme			
	control	25	50	75	100	25	50	75	100
Final weight (Kg)	1.80217	2.01917	1.95233	1.85933	2.02083	1.70933	1.64967	1.69967	2.0895
TFI (kg)	7.56168	7.99596	7.99848	7.86996	8.0934	7.73388	7.90524	7.39704	8.106
FCR	6.8	6.47	6.36	7.39	6.09	7.63	8.33	7.36	5.8
Cost kg/diet (N/kg)	222.42	216.76	211.17	205.54	199.92	217.68	212.06	206.44	200.81
T. cost feeding(N/kg/r)	1681.869	1733.204	1689.039	1617.592	1618.033	1683.511	1676.385	1527.045	1627.766
Feeding cost/gain(kg/r)	1512.456	1402.437	1343.041	1518.941	1217.513	1660.898	1766.46	1519.398	1164.698
Revenue	3243.906	3634.506	3514.194	3346.794	3637.494	3076.794	2969.406	2889.439	3552.15
TPC	3057.943	3151.281	3070.98	2941.076	2941.877	3060.929	3047.973	2776.445	2959.574
Profit	185.9626	483.2255	443.214	405.7184	695.6167	15.86491	-78.5671	112.9937	592.5757

Revenue = Assuming a kg of meat of rabbit cost #1800 185.9626. TPC =Feeding cost = 55% TPC = Total production cost. TFI = Total feed intake. FCR = Feed conversion ratio (Aduku and Olukosi 1990).

Economic of production: - As observed in Table 3, the cost kg per diets decreased from 222.42 N/kg in control (0 %) to 199.92 kg at 100 % sorghum diets without enzyme supplementation and N222.42 N/kg control (0 %) to 200.81 N/kg at 100 % sorghum diet with enzymes supplementation. Diets replaced with 100 % sorghum with and without enzymes inclusion gave optimum cost compared to control. This is because, sorghum have less commercial value compared to maize within the study area. Maize was more expensive than

sorghum during the period of study. This result confirmed the reported report by Gbenge and Ikurior (2019) who replaced maize with sorghum varieties at inclusion different levels in diets of growing rabbits. This finding is also supported with the work of Igwebuike *et al.* (2013a) who reported that, the more the quantity of sorghum in the diet, the less expensive the diet becomes.

Total cost of production also decreased across dietary groups with increased replacement levels of sorghum with or without enzyme supplementation in rabbit diets. These implied that, increasing level of sorghum in rabbit diets increased revenue and cost benefits. This observation was inconsonance with Uchewa *et al*. (2014) and Igwebuike *et al*. (2013b) who reported numerical increased in revenue and benefits in growing rabbits with increased replacement level of maize with alternatives and readily available feed ingredients (sorghum). Revenue and profits per live weight of growing rabbit fed 100 % sorghum with enzyme supplementation of the experimental diets had higher numerical values (₦3637.494 and ₦695.6167) which may be due to differences that existed in weight gain. This was no record of loss and the least benefits/profits obtained at rabbit fed 50 % sorghum diet with enzyme and ₦846.87 was still recommendable to farmers that may be interested in using sorghum based diet as dietary replacement levels for maize.

CONCLUSION AND RECOMMENDATION:

From the result obtained, it can be concluded that, the sorghum used in this study relatively improved growth performance of the growing rabbits, while enzyme supplementation did not affect the growth response of the rabbits and the use of sorghum in diets of rabbits significant reduced the cost of feed and also ensured profitability in rabbit production. However, the supplementation of enzyme gave a reduced profit margin compared to non-enzyme supplementation. Based on the **CONCLUSION** drawn from the study, 100 % sorghum level replacement is recommended to farmers for improved growth and profitability in rabbit production

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